



# NWS Burlington 2021 Spring Flood Outlook

## VT Emergency Management Annual Spring Flood Meetings

9-10 February 2021

John Goff - [john.goff@noaa.gov](mailto:john.goff@noaa.gov)

Maureen Hastings - [maureen.hastings@noaa.gov](mailto:maureen.hastings@noaa.gov)

National Weather Service - Burlington, VT

### 24/7 Contact Information

802-658-0207/802-658-0150

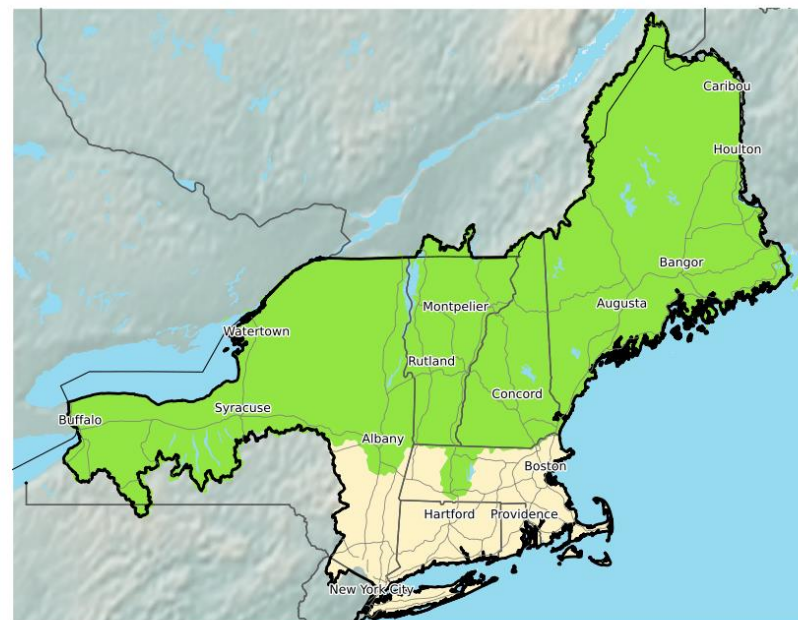
[nwsbtv.info@noaa.gov](mailto:nwsbtv.info@noaa.gov)



# Outline

- Winter/Spring Flooding Climatology
  - Time of year
  - Causes
- Current Recap of Winter 2020-21
- Spring Flood Outlook
  - Below normal

**Spring Flood Potential Outlook**  
Valid: 02/04/2021 07:00 AM - 02/18/2021 07:00 AM EST



National Weather Service  
Northeast RFC  
02/04/2021 07:32 AM EST

Follow Us:     
[weather.gov/nerfc](https://www.weather.gov/nerfc)

**LEGEND - River Flood Risk**



Shaded areas are NERFC forecast region  
Lines are interstate highways



# Winter – Spring Flood Climatology

- **Most common: late February thru April**
  - Due to snow melt and heavy rainfall or heavy rainfall only
- **Early season (December – January)**
  - Same as above or “**Freeze-up**” or **BOTH** (January 2018)
- **More notable recent Winter/Spring flooding**
  - 2020-21: **December 25-26<sup>th</sup> (Otter Creek)**
  - 2019-20 : January 12<sup>th</sup> (Missisquoi R., Coventry, Lamoille R.)
  - 2018-19 : December 22<sup>nd</sup>, April 15<sup>th</sup>
  - 2017-18: January 13<sup>th</sup> (Melt-Rain & Freeze-up), mid-late February
  - 2016-17: February 25-26<sup>th</sup>
  - 2015-16: February 25<sup>th</sup>
- **Multiple or mid-winter events are becoming more common**

Flooding damages Tunbridge fairgrounds





# Recent Winter/Spring Flooding

Two Different Events – Similar Outcomes

Mid-Season (Heavy Rain/Snowmelt/Ice Jams) - Jan 2018

vs.

End of Year (T-storms/Total Loss of Snowpack) – Apr 2019



# Event #1 - 13-15 January 2018 Flooding

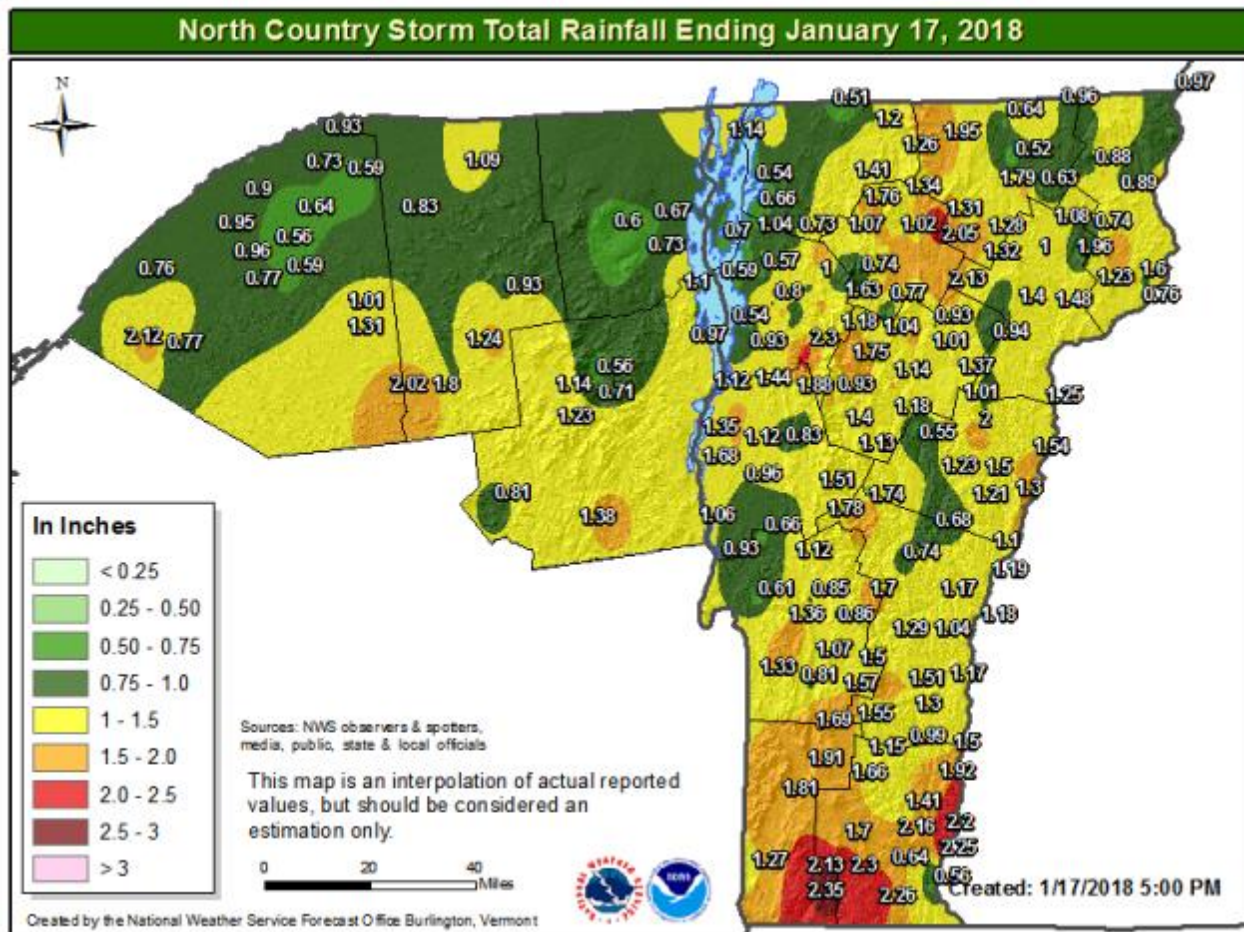
Widespread 1 to 2 inches of rainfall

8-16 inches of snow depth lost...perhaps 1-2" water equivalent

**Snowpack still remains**

## Primarily ICE JAM Related Flooding

- Missisquoi
- Winooski
- Lamoille
- Passumpsic
- Mad
- New Haven
- Connecticut







# 13-15 January 2018

## Record Cold with Normal to Above Normal Snowfall then Rapid Thaw



Lamoille River



Lamoille River at Johnson



Winooski at Montpelier

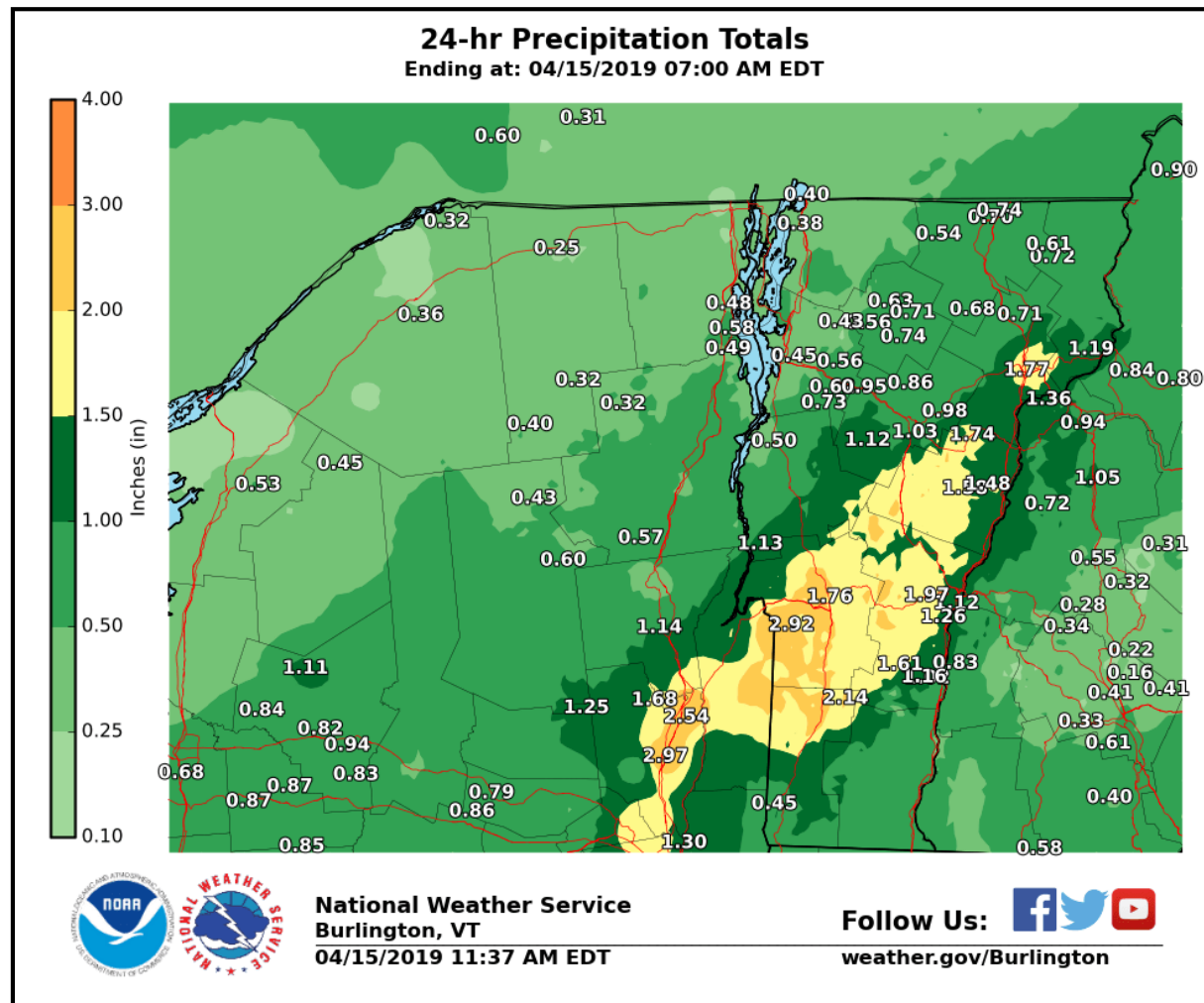


Missisquoi River



# Event #2 - 15 April 2019 Flooding

- **Corridor of 1.5 to 3" of convective rainfall across southern/eastern VT**
  - 8-16" of snow depth lost from high elevations: perhaps an additional 2-3" of water input into watersheds
- **Primarily open water flooding**
  - Otter Creek – major flood level
  - Winooski R.
  - Passumpsic R.
  - Wells R.
- **Some flash flooding noted**



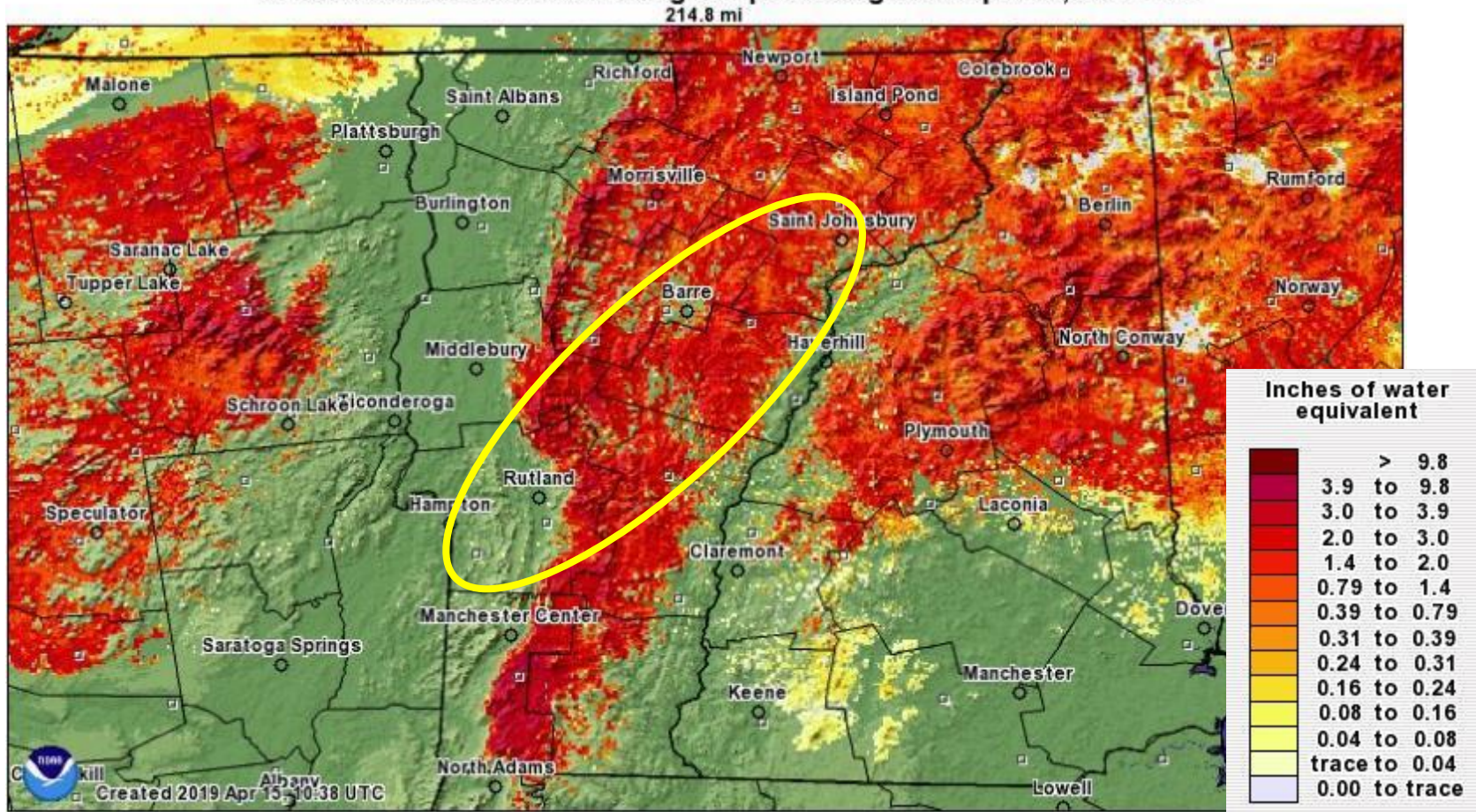




# 14-15 April 2019 Snowmelt

Widespread 2-3 inches with localized up to 5 inches of water equivalent melted into streams/rivers

Total Modeled Snow Melt during 72h preceding 2019 April 15, 5:00 UTC





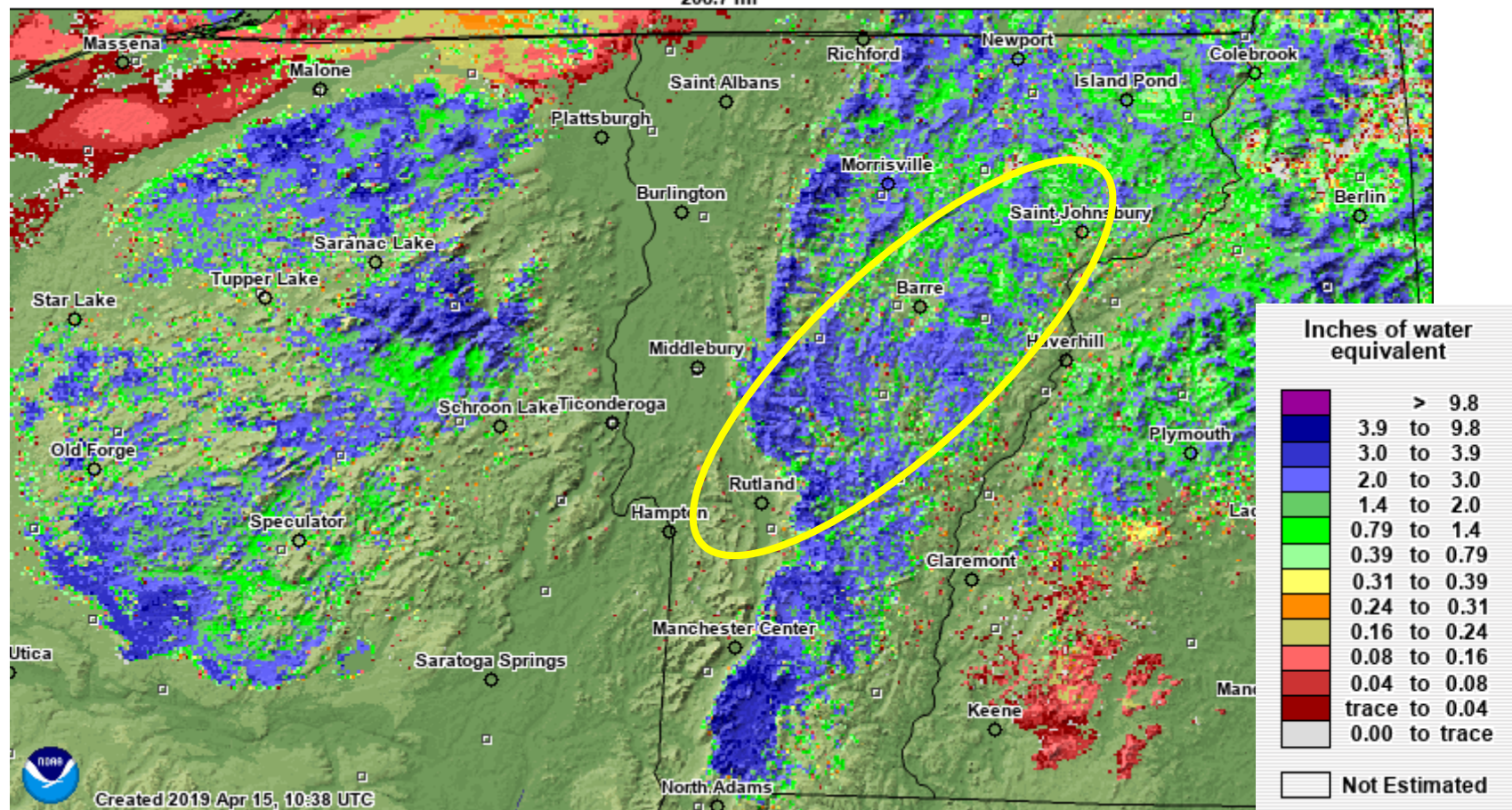


# 14-15 April 2019 Snowmelt

Widespread 2-3 inches with localized up to 5 inches of water equivalent melted into streams/rivers

Total Modeled Snow Melt during 72h preceding 2019 April 15, 5:00 UTC

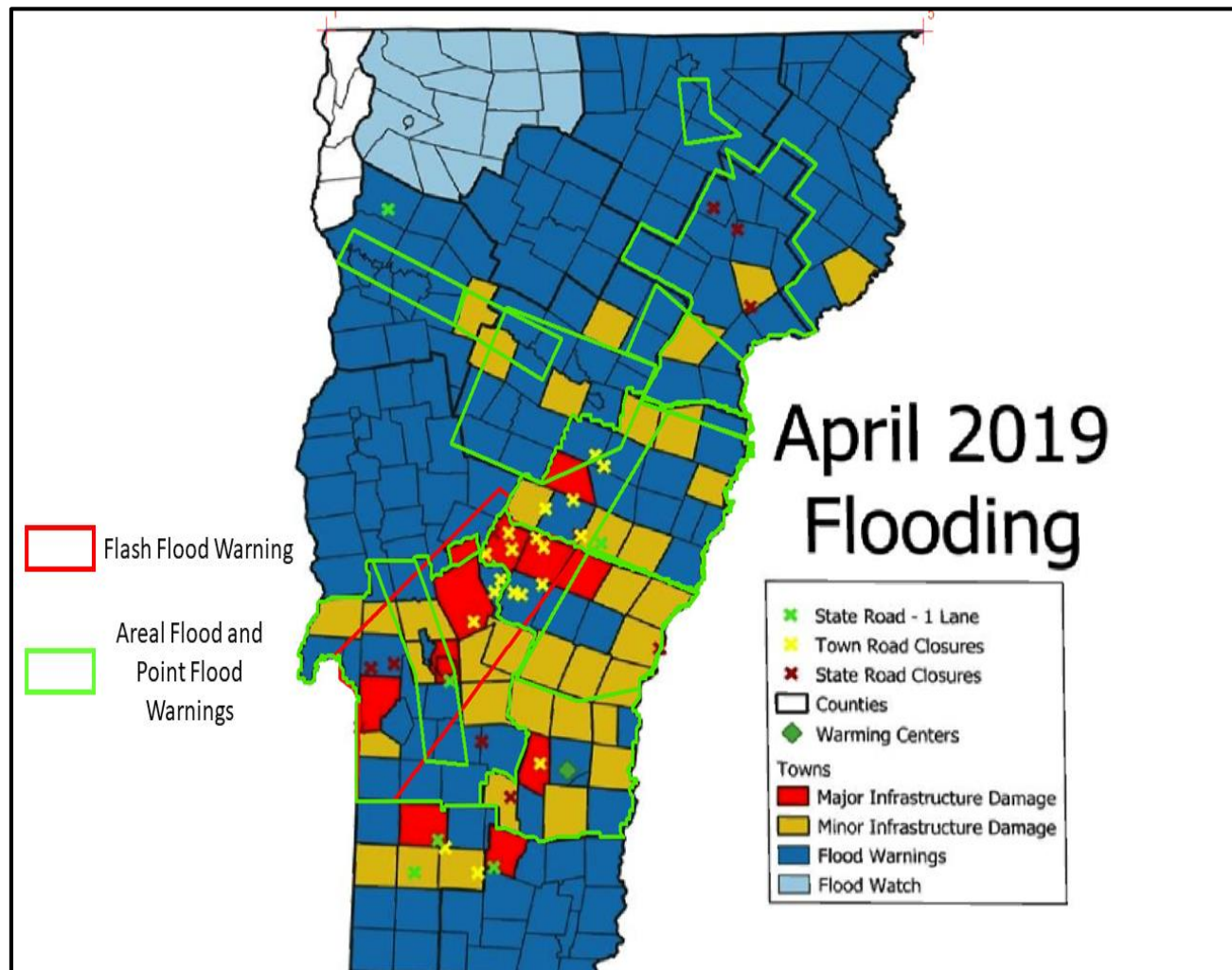
208.7 mi





# Significant Impacts from high water

- **Significant damage to roads and bridges**
  - Mainly across south central/east-central VT
- **Some structures impacted/affected**
- **FEMA/Federal disaster, mainly for public assistance (DR-4445)**

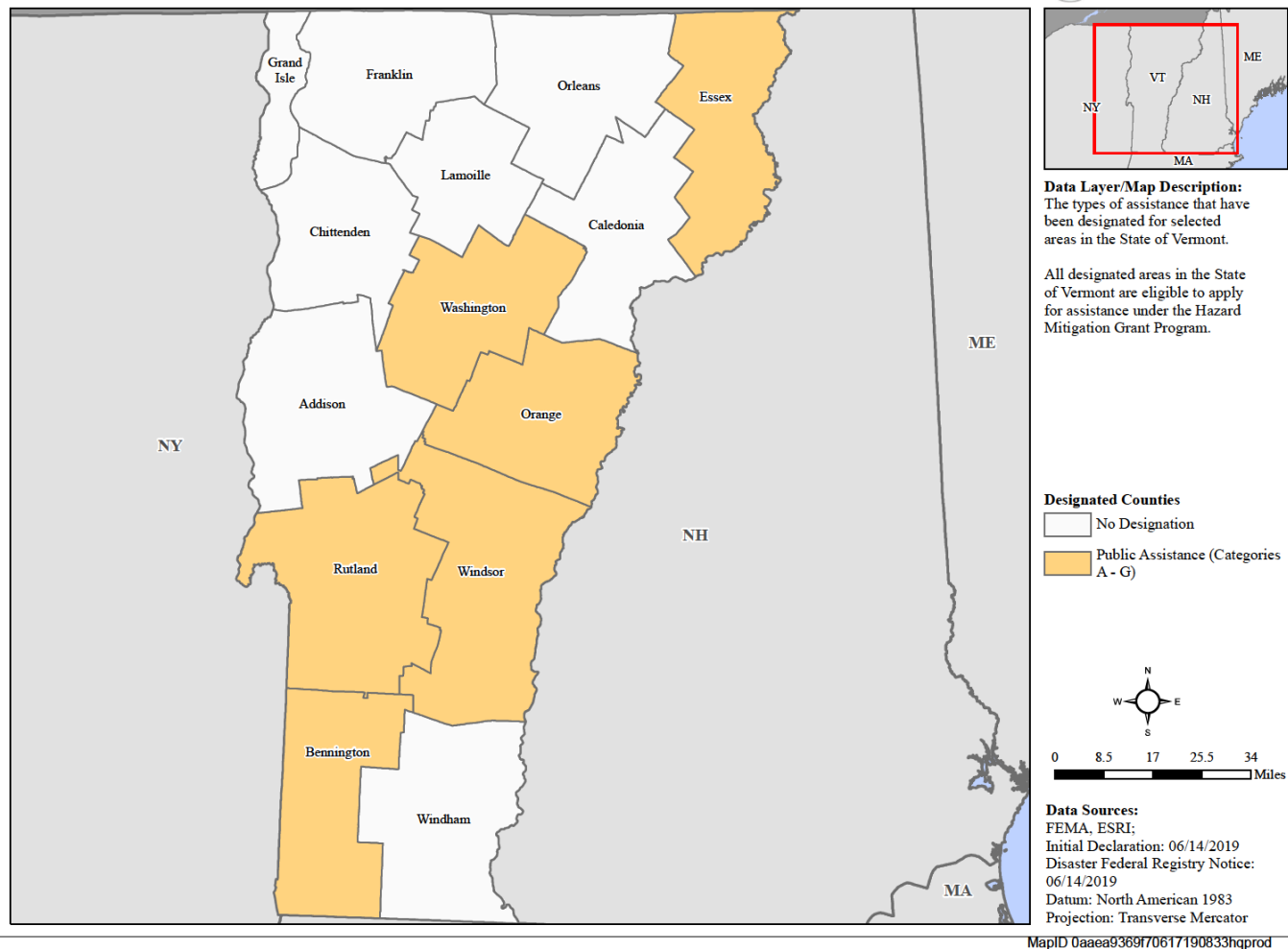






# FEMA DR-4445

## FEMA-4445-DR, Vermont Disaster Declaration as of 06/14/2019







# 15 April 2019 - Snapshots





# Winter-Spring Flooding Causes

*"It's All About the Rainfall"*

- **Precursors –**
  - **Normal -> Above Normal Snowpack**
    - Snow Depth and Water Content
  - **Substantial Ice Thickness**
    - Existing Ice Jam?
  - **Race between breakup vs. melt out**

- **Causative Event**
  - **Significant Warm-up**
    - Promoting snowmelt, increase water flows
    - Ability to lift, move, break-up and ice jams
  - **Heavy Rainfall\*\***

*\*\*Most important*



# Ice Jams and Ice Out Scenarios



Thermal ("Melt out")

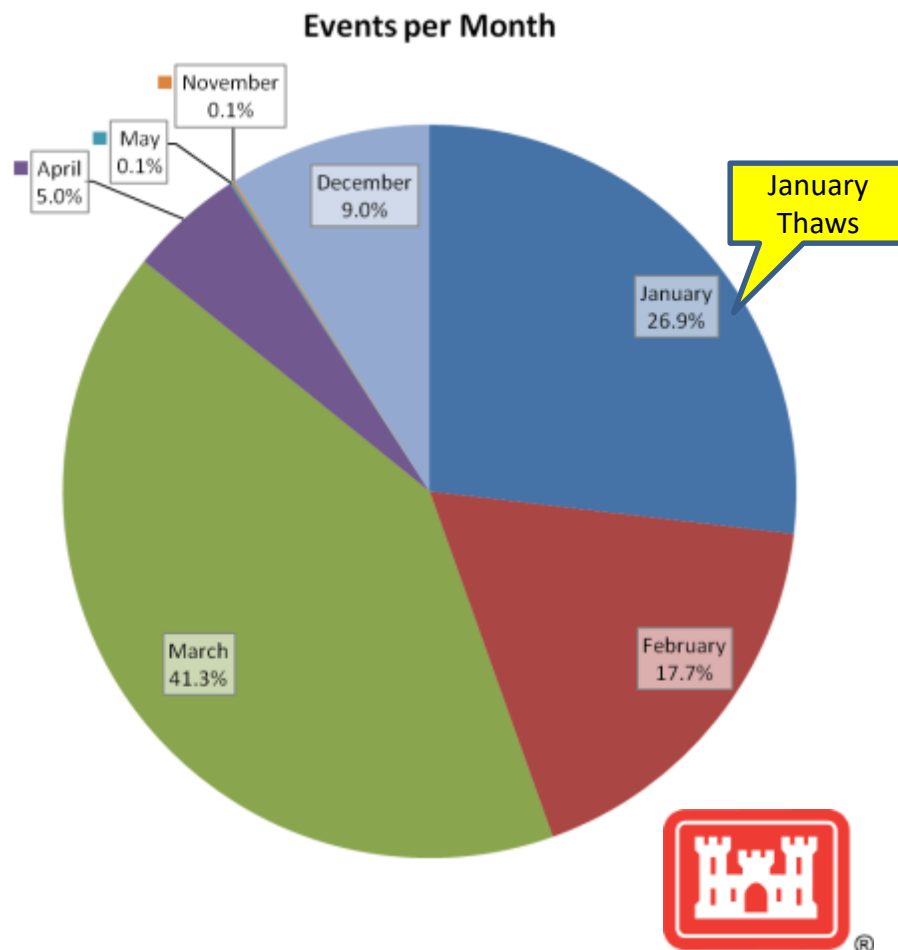
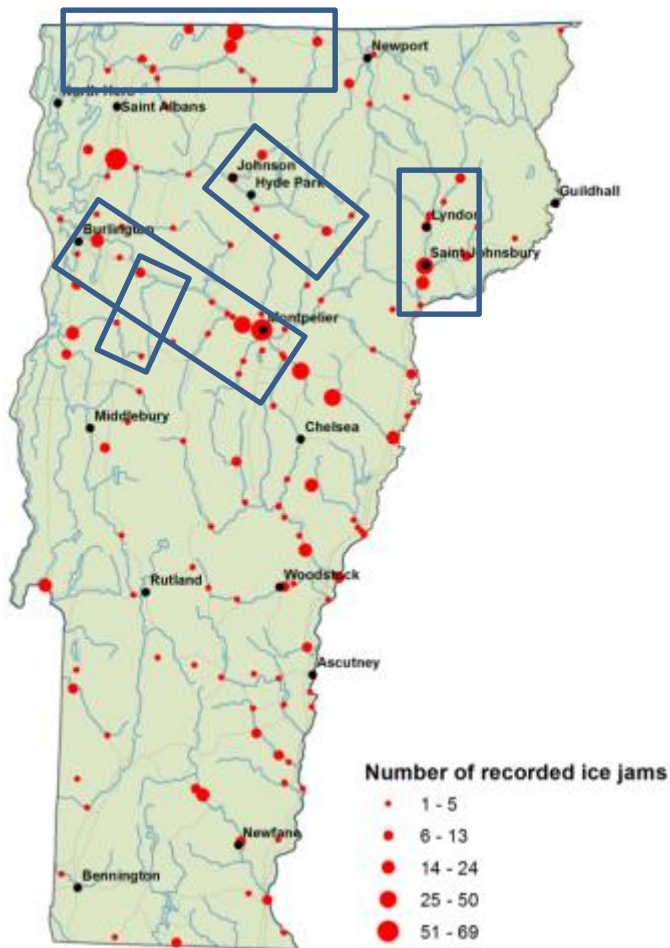
VS.

Mechanical ("Breakup")





# Recorded Ice Jams in Vermont





# Ice Out Scenarios - Thermal

Annual Race of Thermal vs. Mechanical...usually ends up BOTH!!!

## Thermal ("Melt out")

- Mild, sunny days/Cool, sub-freezing nights (Lasting few days)
- Long duration, gradual warmth with no significant rainfall
- Ice cover thins, weakens and melts in place, or forms minor jams. Sunshine is the biggest role player.
- Open channels
- Mitigation efforts by communities
  - Leaf debris, public wastewater





# Ice Out Scenarios - Mechanical

Annual Race of Thermal vs. Mechanical...usually ends up BOTH!!!

## Mechanical ("Breakup")

- **Significant ice thickness**
  - Extended period of freezing temperatures
  - Limited thawing
- **Sudden increase in river flow**
  - Rainfall and/or snowmelt
  - Ice break up or water running over ice
  - Snowmelt alone usually doesn't do it
  - Need river rise  $\geq 3X$  ice thickness
- **Jam Site – ice stops moving and blocks channel due to:**
  - Change of channel slope
  - Intact ice cover – site of freeze-up jam
  - Impediment – bridge piers







# Now to the Current...

- Winter recap thus far
- Winter/Spring Flood Outlook





# Meteorological Winter So Far...

Montpelier, VT

Daily Temperature Data – BARRE MONTEPELIER KNAPP STATE AP, VT

Period of Record – 1948-06-01 to 2021-02-05. Normals period: 1981-2010. Click and drag to zoom chart.

**No significant thawing episode this winter. Simply went from mild to cold.**

**Limited River Ice Formation due to mild early winter**

**River ice formation increases significantly**

● Observed temperature range (2020-2021) ● Normal temperature range — Record Max — Record Min

Powered by ACIS





# River Ice coverage

- Current ice jam threat minimal.
- River ice coverage and thickness continues to increase due to recent cold weather.
- Some open channels on the Winooski River and southern watersheds.
- Overall ice coverage nearing normal but thickness remains somewhat below average for early February (6-9").
- Long term ice jam flood threat is now normal.







# Current Conditions – Snow Data

## Snow Depths

Champlain, Lower CT and St. Lawrence Valleys: **8 - 18"**

Northeast VT and mid-terrain (1500-2500'): **15 - 25"**

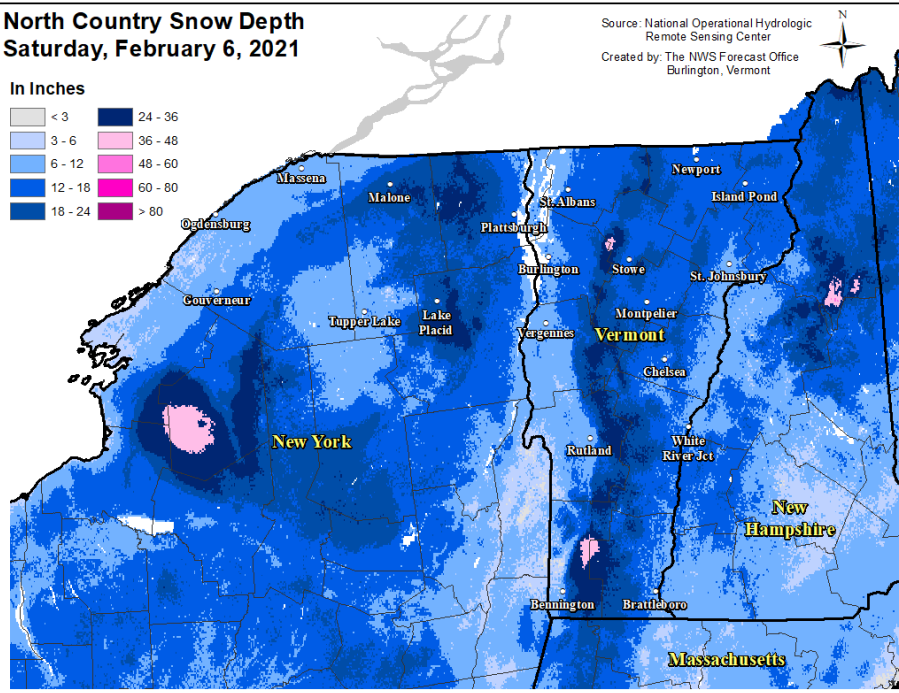
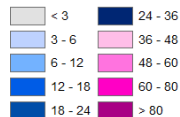
Higher terrain and summits (> 2500') : **20 – 30"+**

**Near normal broad valleys**

**Below normal mid and high terrain**

**North Country Snow Depth**  
Saturday, February 6, 2021

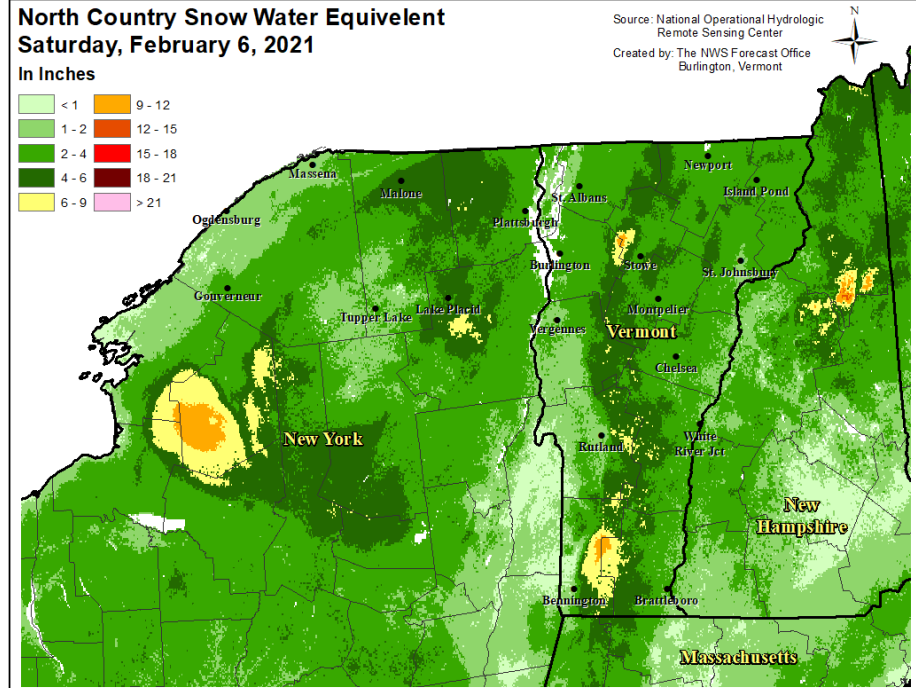
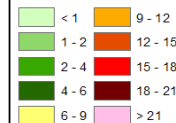
In Inches



Source: National Operational Hydrologic  
Remote Sensing Center  
Created by: The NWS Forecast Office  
Burlington, Vermont

**North Country Snow Water Equivalent**  
Saturday, February 6, 2021

In Inches



Source: National Operational Hydrologic  
Remote Sensing Center  
Created by: The NWS Forecast Office  
Burlington, Vermont

## Water Equivalents (Water Content)

Areas below 1500' including Champlain, Lower CT and St.

Lawrence Valleys : **1.5 – 3.5"**

Mid-terrain (1500-2500'): **2.5 – 4.5"**

Higher Summits: **5-6"**

**Near Normal valleys**

**Below Normal mid and high terrain**

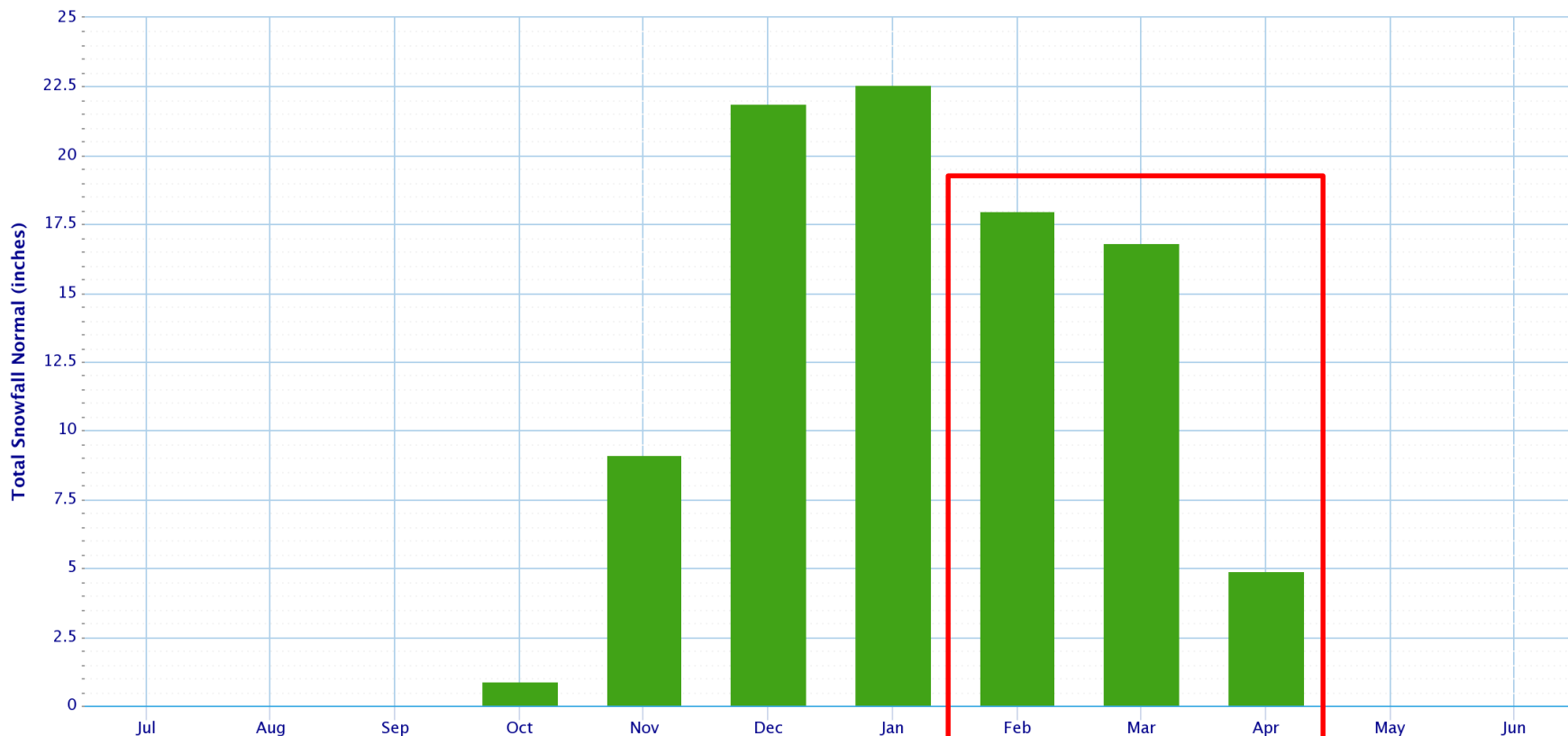


# It's Still Winter...

>35% of Snowfall occurs after February 2<sup>nd</sup>

Monthly Climate Normals (1981–2010) – BARRE MONTPELIER KNAPP STATE AP, VT

Click and drag to zoom to a shorter time interval



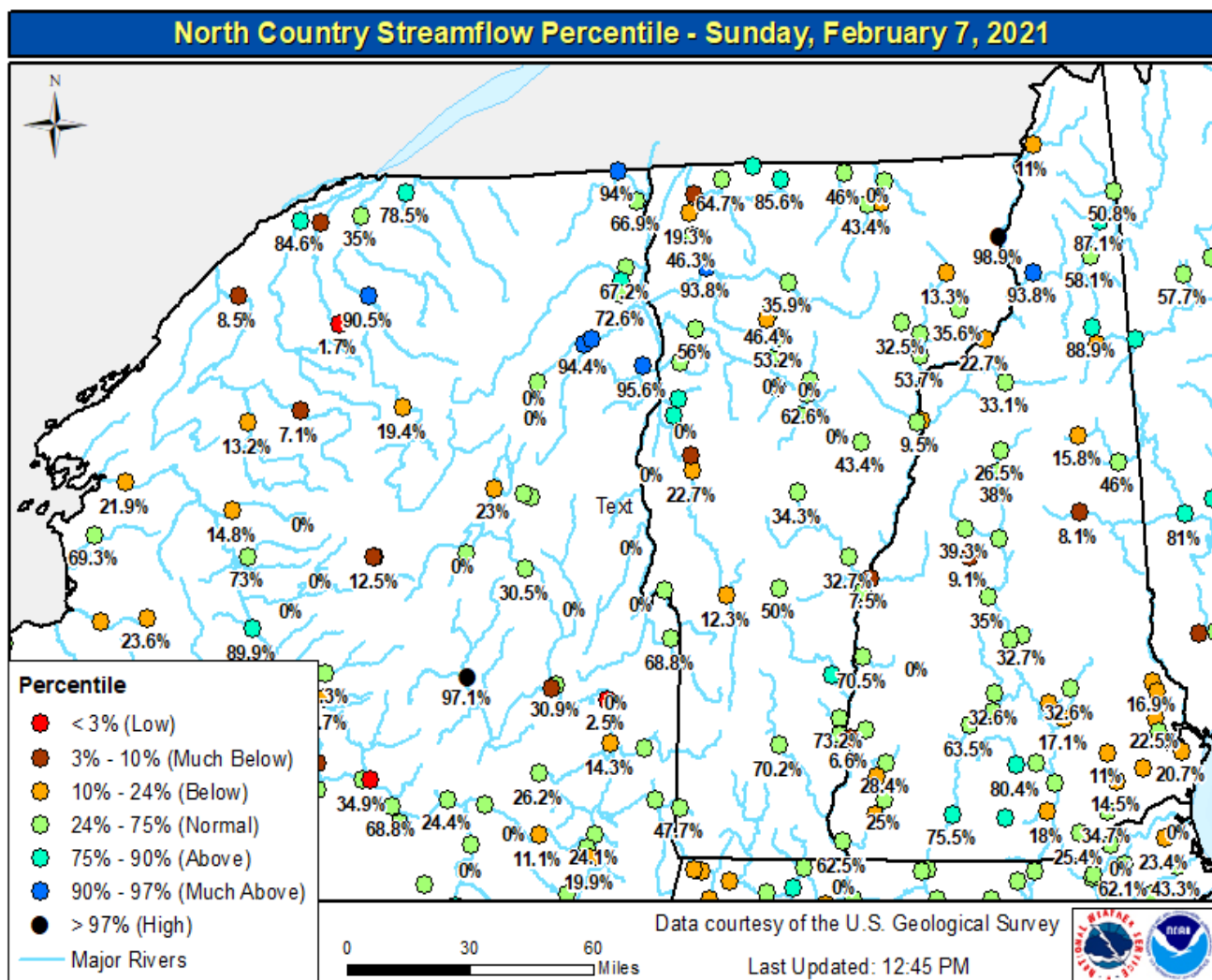
Powered by ACIS



# Current conditions: Stream flows

Near normal with below normal ice coverage

- Streamflows a mix of normal to below normal levels.
- Some lingering effects of drought.
- Melting of extant snowpack will help to recharge ground moisture in spring.



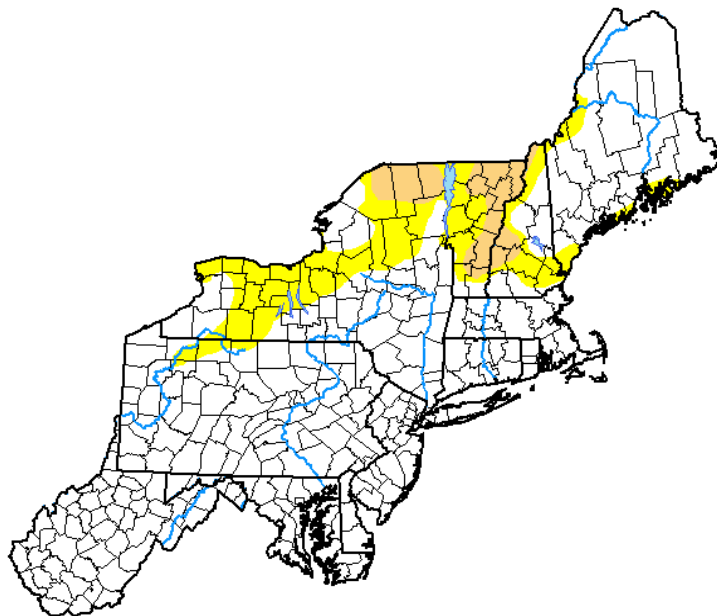




# National Drought Monitor Map

- Abnormally dry to moderate drought conditions persist across most of the state.
- Improvement in future months heavily dependent on spring rains.
- Capacity of soil to absorb moisture may aid in lessening overall flood threat.

## U.S. Drought Monitor Northeast



**February 2, 2021**

(Released Thursday, Feb. 4, 2021)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	81.52	18.48	4.60	0.00	0.00	0.00
<b>Last Week</b> 01-26-2021	79.65	20.35	4.60	0.00	0.00	0.00
<b>3 Months Ago</b> 11-03-2020	38.83	61.17	37.14	6.25	0.59	0.00
<b>Start of Calendar Year</b> 12-29-2020	77.61	22.39	3.63	0.00	0.00	0.00
<b>Start of Water Year</b> 09-29-2020	29.83	70.17	45.34	26.30	3.91	0.00
<b>One Year Ago</b> 02-04-2020	98.49	1.51	0.00	0.00	0.00	0.00

### Intensity:

None	D2 Severe Drought
D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate Drought	D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

### Author:

Brad Rippey  
U.S. Department of Agriculture



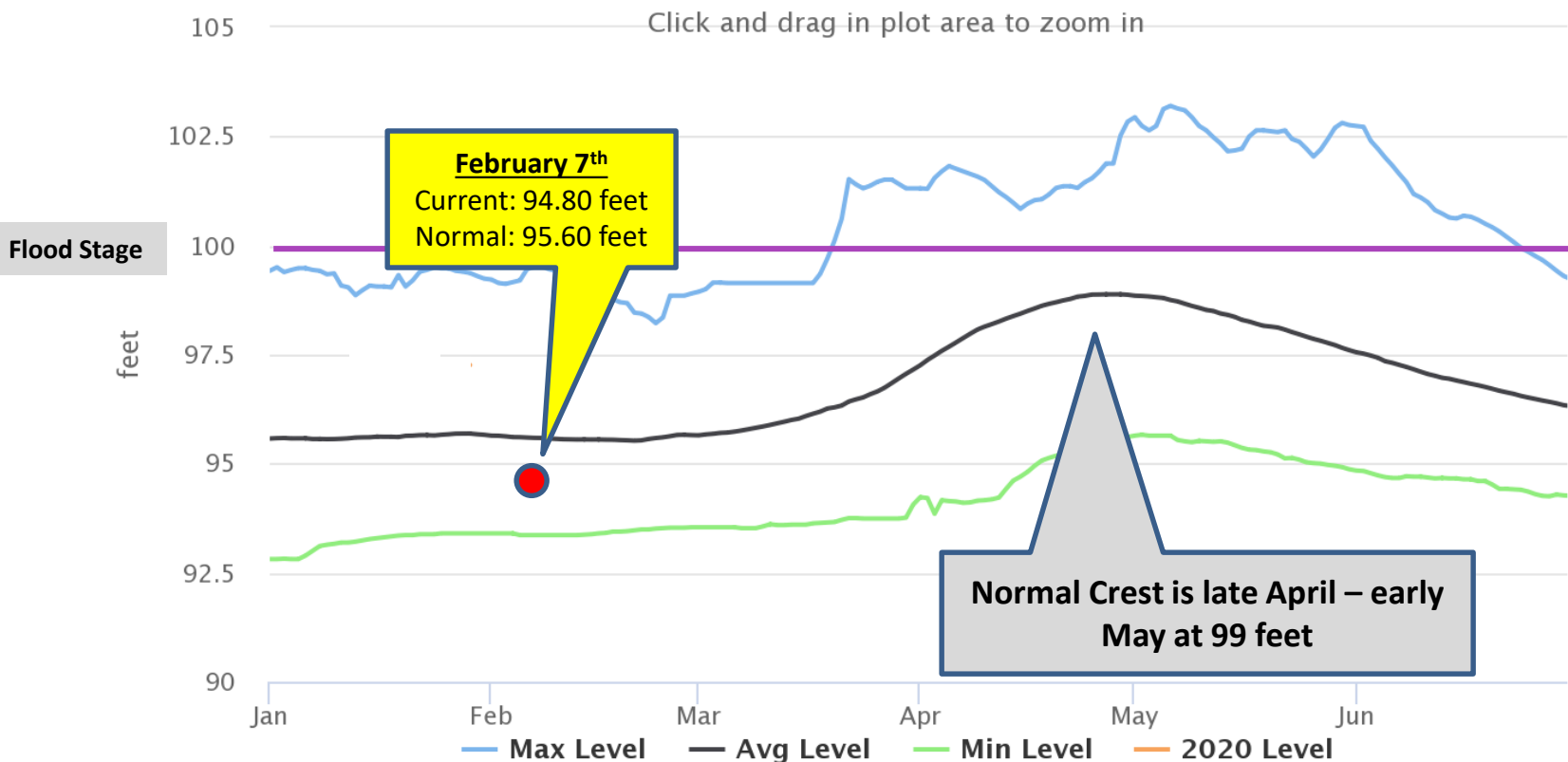
[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)



# Lake Champlain

No Immediate Concerns – ALL About Future Precipitation through May

## Lake Champlain Extremes and 2020 Level



Highcharts.com



# 8-14 Day Outlooks

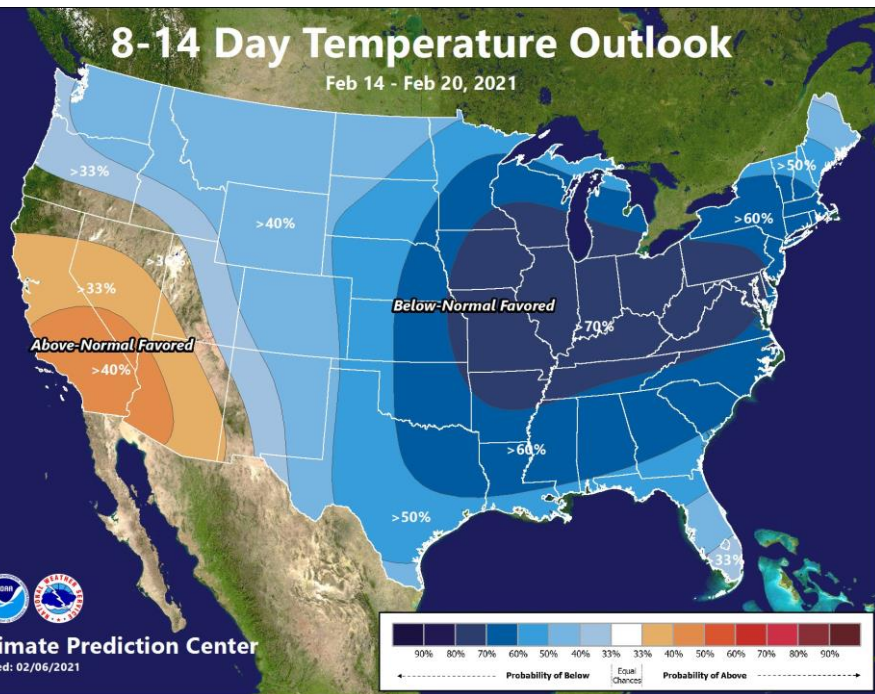
Normals - **Highs:** 20s to Lower 30s **Lows:** 8-15°

TEMPERATURES: **Below Normal**

PRECIPITATION: **Near to Below Normal**

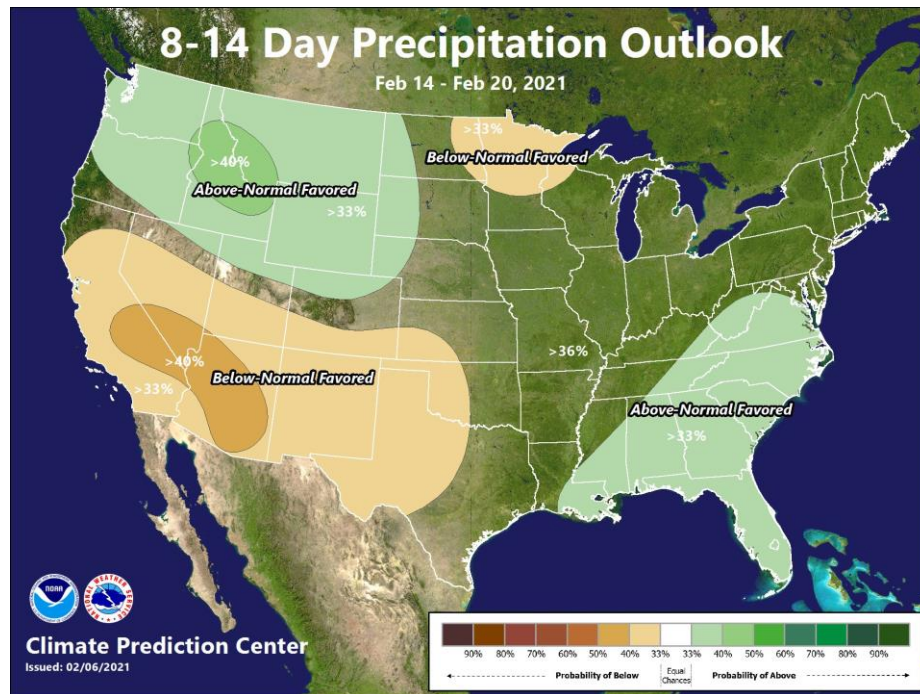
## 8-14 Day Temperature Outlook

Feb 14 - Feb 20, 2021



## 8-14 Day Precipitation Outlook

Feb 14 - Feb 20, 2021





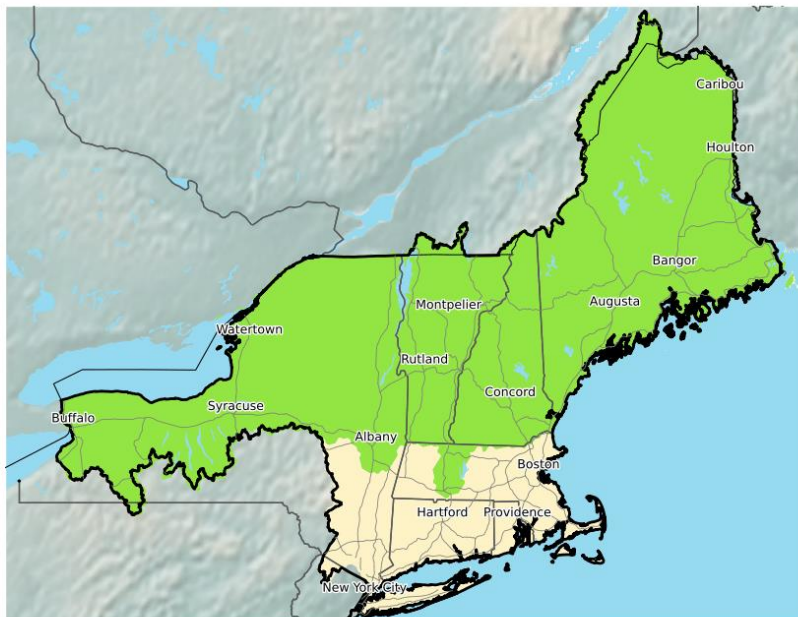


# Spring Flood Outlook SUMMARY

Issued every 2 weeks on Thursday – NEXT is February 18<sup>th</sup>

## Spring Flood Potential Outlook

Valid: 02/04/2021 07:00 AM - 02/18/2021 07:00 AM EST



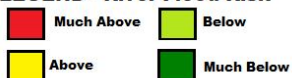
National Weather Service  
Northeast RFC  
02/04/2021 07:32 AM EST

Follow Us:



weather.gov/nerfc

### LEGEND - River Flood Risk



Shaded areas are NERFC forecast region

Lines are interstate highways

- **BELOW NORMAL over the next 2 weeks** due to normal to below normal snowpack and expectation of cold temperatures limiting melt potential.
- **Long term flood threat (late Feb/Mar) NEAR NORMAL.**
- **Current Conditions**
  - Near to below Normal Snow packs
  - Below Normal River Ice thickness
- **Greatest Threat to Flooding**
  - Above Normal Rainfall +
  - Sudden Warm-up / Melting
- **Monitor Future Forecasts and River Ice conditions**

<http://www.weather.gov/nerfc/springfloodpotential> (Graphic)

<http://w1.weather.gov/data/BTV/ESFBTV> (Text)





# Questions???

Please feel free to contact us 24/7 via:

1. Telephone: [802-863-4279](tel:802-863-4279)
2. NWSChat for eligible & registered users at <https://nwschat.weather.gov/live/>
3. Email: [nwsbvtv.info@noaa.gov](mailto:nwsbvtv.info@noaa.gov) **\*\*New e-mail address\*\***



**NATIONAL WEATHER SERVICE**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

Local forecast by "City, ST" or ZIP code  
Enter location:  Go  
[Location Help](#)

**News Headlines**

- [Wind Advisory in Effect for Portions of the Area Noon through Midnight Wednesday](#)
- [Strong El Niño Sets the Stage For 2015-2016 Winter Weather - NOAA's Official U.S. Winter Outlook](#)
- [The 2015 Fall Edition of The Four Seasons Newsletter is Available!](#)

**NWS Forecast Office Burlington, VT**  
[Weather.gov](#) > Burlington, VT

Burlington, VT  
Weather Forecast Office

Current Hazards Current Conditions Radar Forecasts Rivers and Lakes Climate and Past Weather Local Programs

Click on the map below to zoom in.

Watches, Warnings & Advisories

- High Wind Warning
- Small Craft Advisory
- Wind Advisory
- Hazardous Weather Outlook

Last Map Update: Tue, Oct 27, 2015 at 4:12:10 pm EDT



National Weather Service  
**Burlington**

Follow Us:   
[www.weather.gov/btv](http://www.weather.gov/btv)

[www.weather.gov/btv](http://www.weather.gov/btv)

